# Material Safety Data Sheet

Version 1.9 MSDS Number 300000000026
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## 1. PRODUCT AND COMPANY IDENTIFICATION

| | | |
|---|---|---|
| Product name | : | Chlorine |
| Chemical formula | : | Cl2 |
| Synonyms | : | Chlorine |
| Product Use Description | : | General Industrial |
| Company | : | Air Products and Chemicals,Inc<br>7201 Hamilton Blvd.<br>Allentown, PA 18195-1501 |
| Telephone | : | 1-800-345-3148 Chemicals<br>1-800-752-1597 Gases and Electronic Chemicals |
| Emergency telephone number | : | 800-523-9374 USA<br>01-610-481-7711 International |

## 2. COMPOSITION/INFORMATION ON INGREDIENTS

| Components | CAS Number | Concentration (Volume) |
|---|---|---|
| Chlorine | 7782-50-5 | 100 % |

Concentration is nominal. For the exact product composition, please refer to Air Products technical specifications.

## 3. HAZARDS IDENTIFICATION

### Emergency Overview

Reacts with water to form corrosive acids.
Vigorously accelerates combustion.
May react violently with combustible materials.
Keep oil, grease, and combustibles away.
Do not breathe gas.
Compressed liquefied gas.

### Potential Health Effects

| | | |
|---|---|---|
| Inhalation | : | May be fatal if inhaled. If inhaled, remove to fresh air. |
| Eye contact | : | May cause eye irritation. May cause permanent eye injury. May cause blindness. |
| Skin contact | : | Causes skin irritation. Causes skin burns. Contact with liquid may cause cold burns/frost bite. |

### Exposure Guidelines

| | | |
|---|---|---|
| Primary Routes of Entry | : | Inhalation |
| Target Organs | : | None known. |
| Symptoms | : | Irritating to eyes and respiratory system. Cough. |

### Aggravated Medical Condition

Acute or chronic respiratory conditions.

### Environmental Effects

Dangerous for the environment.

## 4. FIRST AID MEASURES

| | | |
|---|---|---|
| General advice | : | The potential for hydrogen chloride formation exists with every exposure, therefore its toxicity must be considered. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped. |
| Eye contact | : | In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Keep eye wide open while rinsing. |
| Skin contact | : | Immediate medical treatment is necessary as untreated wounds from corrosion of the skin heal slowly and badly. Flush with copious amounts of water until treatment is available. Remove contaminated clothing. Drench affected area with water for at least 15 minutes |
| Ingestion | : | Ingestion is not considered a potential route of exposure. |
| Inhalation | : | Move to fresh air. In case of shortness of breath, give oxygen. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. Mouth to mouth resuscitation is not recommended. If unconscious place in recovery position and seek medical advice. Consult a doctor. |

Notes to physician

| | | |
|---|---|---|
| Treatment | : | Treat bronchospasm and laryngeal edema if present. Observe for delayed chemical pneumonitis, pulmonary hemorrhage or edema. |

## 5. FIRE-FIGHTING MEASURES

| | | |
|---|---|---|
| Suitable extinguishing media | : | All known extinguishing media can be used. |
| Specific hazards | : | Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Oxidant. Strongly supports combustion. May react violently with combustible materials. Some materials which are noncombustible in air may burn in the presence of an oxidizer. Use of water may result in the formation of very toxic aqueous solutions. Move away from container and cool with water from a protected position. Keep adjacent cylinders cool by spraying with large amounts of water until the fire burns itself out. Keep containers and |

surroundings cool with water spray. Do not allow run-off from fire fighting to enter drains or water courses. Gas is heavier than air and may collect in low areas or travel along the ground where there may be an ignition source present.

Special protective equipment for fire-fighters : Use self-contained breathing apparatus and chemically protective clothing.

## 6. ACCIDENTAL RELEASE MEASURES

Personal precautions : Evacuate personnel to safe areas. Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Use chemically protective clothing. Ventilate the area.

Environmental precautions : Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

Methods for cleaning up : Ventilate the area. Approach suspected leak areas with caution.

Additional advice : Large releases may require considerable downwind evacuation. If possible, stop flow of product. Increase ventilation to the release area and monitor concentrations. If leak is from cylinder or cylinder valve, call the Air Products emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

## 7. HANDLING AND STORAGE

### Handling

Carbon steel, stainless steel, Monel or copper are suitable materials of construction when no moisture is present. Hastelloy, platinum or gold offer good resistance to corrosion when moisture is present. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Only experienced and properly instructed persons should handle compressed gases. Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Close

valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shocks which may cause damage to their valve or safety devices. Never attempt to lift a cylinder by its valve protection cap or guard. Do not use containers as rollers or supports or for any other purpose than to contain the gas as supplied. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Keep container valve outlets clean and free from contaminates particularly oil and water. Do not smoke while handling product or cylinders. Never re-compress a gas or a gas mixture without first consulting the supplier. Never attempt to transfer gases from one cylinder/container to another. Always use backflow protective device in piping. Purge system with dry inert gas (e.g. helium or nitrogen) before gas is introduced and when system is placed out of service. Avoid suckback of water, acid and alkalis. Installation of a cross purge assembly between the cylinder and the regulator is recommended. When returning cylinder install valve outlet cap or plug leak tight. Never permit oil, grease, or other readily combustible substances to come into contact with valves or containers containing oxygen or other oxidants. Do not use rapidly opening valves (e.g. ball valves). Open valve slowly to avoid pressure shock. Never pressurize the entire system at once. Use only with equipment cleaned for oxygen service and rated for cylinder pressure. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50°C (122°F). Prolonged periods of cold temperature below -30°C (-20°F) should be avoided. Never attempt to increase liquid withdrawal rate by pressurizing the container without first checking with the supplier. Never permit liquefied gas to become trapped in parts of the system as this may result in hydraulic rupture.

### Storage

Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Full containers should be stored so that oldest stock is used first. Keep containers tightly closed in a cool, well-ventilated place. Stored containers should be periodically checked for general condition and leakage. Observe all regulations and local requirements regarding storage of containers. Local codes may have special requirements for toxic gas storage. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Keep container tightly closed in a dry and well-ventilated place. Store containers in location free from fire risk and away from sources of heat and ignition. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Display "No Smoking or Open Flames" signs in the storage areas. Return empty containers in a timely manner. Flammable storage areas should be separated from oxygen and other oxidizers by a minimum distance of 20 ft. (6.1 m.) or by a barrier of non-combustible material at least 5 ft. (1.5 m.) high, having a fire resistance rating of at least 1/2 hour.

### Technical measures/Precautions

Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance with local regulations. Keep away from combustible material. Where necessary containers containing oxygen and oxidants should be separated from flammable gases by a fire resistant partition. Segregate from flammable gases and other flammable materials in store.

## 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

### Engineering measures

Provide natural or explosion-proof ventilation adequate to ensure concentrations are kept below exposure limits.

### Personal protective equipment

Respiratory protection : Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the

exposure limits. Users of breathing apparatus must be trained.

Hand protection : Acid resistant gloves.
Sturdy work gloves are recommended for handling cylinders.
The breakthrough time of the selected glove(s) must be greater than the intended use period.

Eye protection : Safety glasses recommended when handling cylinders.
A full faceshield should be worn in addition to safety glasses when connecting, disconnecting or opening cylinders.

Skin and body protection : Acid resistant gloves (e.g. butyl rubber, neoprene, polyethylene) and splash suit when connecting, disconnecting or opening cylinders.
Cold temperatures may cause embrittlement of protective material resulting in breakage and exposure.
Contact with cold evaporating liquid on gloves or suit may cause cryogenic burns or frostbite.
Safety shoes are recommended when handling cylinders.

Special instructions for protection and hygiene : Ensure adequate ventilation, especially in confined areas. Provide good ventilation and/or local exhaust to prevent accumulation of concentrations above exposure limits. Gloves must be clean and free of oil and grease.

### Exposure limit(s)

| | | | |
|---|---|---|---|
| Chlorine | Time Weighted Average (TWA): ACGIH | 0.5 ppm | - |
| Chlorine | Short Term Exposure Limit (STEL): ACGIH | 1 ppm | - |
| Chlorine | Ceiling Limit Value and Time Period (if specified): NIOSH | 0.5 ppm | 1.45 mg/m3 |
| Chlorine | Ceiling Limit Value: OSHA Z1 | 1 ppm | 3 mg/m3 |

## 9. PHYSICAL AND CHEMICAL PROPERTIES

Form : Liquefied gas.

Color : Greenish-yellow.

Odor : Pungent.

Molecular Weight : 70.91 g/mol

Relative vapor density : 2.448 (air = 1)

Relative density : 1.6 (water = 1)

Vapor pressure : 98.62 psia (6.80 bar) at 68 °F (20 °C)

Density : 0.187 lb/ft3 (0.0030 g/cm3) at 70 °F (21 °C)
Note: (as vapor)

Specific Volume : 5.39 ft3/lb (0.3365 m3/kg) at 70 °F (21 °C)

| | | |
|---|---|---|
| Boiling point/range | : | -29 °F ( 33.8 °C) |
| Critical temperature | : | 291 °F (144 °C) |
| Melting point/range | : | -150 °F (-101 °C) |
| Water solubility | : | 8.620 g/l |

## 10. STABILITY AND REACTIVITY

| | | |
|---|---|---|
| Stability | : | Stable under normal conditions. |
| Materials to avoid | : | Water.<br>Aluminium.<br>Strong bases.<br>Brass.<br>May react violently with combustible materials.<br>May react violently with reducing agents.<br>Violently oxidises organic material.<br>Reacts with water to form corrosive acids.<br>May react violently with alkalis.<br>With water causes rapid corrosion of some metals.<br>Avoid oil, grease and all other combustible materials.<br>Organic materials.<br>Flammable materials. |

## 11. TOXICOLOGICAL INFORMATION

### Acute Health Hazard

| | | |
|---|---|---|
| Ingestion | : | No data is available on the product itself. |
| Inhalation | : | LC50 (1 h) : 293 ppm<br>Species : Rat. |
| Skin. | : | No data is available on the product itself. |

### Chronic Health Hazard

Pregnant rats exposed for one hour to 300 ppm hydrochloric acid had a five-fold higher incidence of fetal death than control rats. In addition, the surviving rat pups showed disturbances in kidney function. Rats exposed 6 hours/day, 5 days/week for 6 weeks to Chlorine at a concentration of 1, 3, or 9 ppm exhibited respiratory tract effects and gained less weight than control animals. The severity of these effects was dose-related. In addition, liver and kidney effects were observed in the rats treated at > 3 ppm.

## 12. ECOLOGICAL INFORMATION

### Ecotoxicity effects

| | | |
|---|---|---|
| Aquatic toxicity | : | May cause pH changes in aqueous ecological systems.Toxic to aquatic organisms.May cause pH changes in aqueous ecological systems. |

Toxicity to other organisms : No data available.

### Persistence and degradability

Mobility : No data available.

Bioaccumulation : No data is available on the product itself.

### Further information

Toxic to aquatic organisms.

## 13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products : In accordance with local and national regulations. Return unused product in orginal cylinder to supplier. Contact supplier if guidance is required. Must not be discharged to atmosphere.

Contaminated packaging : Return cylinder to supplier.

## 14. TRANSPORT INFORMATION

### CFR

Proper shipping name : Chlorine
Class : 2.3 (8)
UN/ID No. : UN1017

### IATA

Proper shipping name : Chlorine
UN/ID No. : UN1017

### IMDG

Proper shipping name : CHLORINE
Class : 2.3 (8)
UN/ID No. : UN1017

### CTC

Proper shipping name : CHLORINE
Class : 2.3 (8)
UN/ID No. : UN1017

Further Information
Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency.

## 15. REGULATORY INFORMATION

OSHA Hazard Communication Standard (29 CFR 1910.1200) Hazard Class(es)
Toxic Oxidizer. Corrosive. Compressed Gas.

| Country | Regulatory list | Notification |
|---|---|---|
| USA | TSCA | Included on Inventory. |
| EU | EINECS | Included on Inventory. |
| Canada | DSL | Included on Inventory. |
| Australia | AICS | Included on Inventory. |
| Japan | ENCS | Included on Inventory. |
| South Korea | ECL | Included on Inventory. |
| China | SEPA | Included on Inventory. |
| Philippines | PICCS | Included on Inventory. |

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification:
Acute Health Hazard

Fire Hazard. Sudden Release of Pressure Hazard.

EPA SARA Title III Section 313 (40 CFR 372) Component(s) above 'de minimus' level:
Chlorine

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)
This product does not contain any chemicals known to State of California to cause cancer, birth defects or any other harm.

## 16. OTHER INFORMATION

### NFPA Rating

| | |
|---|---|
| Health | : 4 |
| Fire | : 0 |
| Instability | : 0 |
| Special | : OX |

### HMIS Rating

| | |
|---|---|
| Health | : 3 |
| Flammability | : 0 |
| Physical hazard | : 2 |

Prepared by : Air Products and Chemicals, Inc. Global EH&S Product Safety Department

For additional information, please visit our Product Stewardship web site at
http//www.airproducts.com/productstewardship/